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ABSTRACT

This paper reports on the educational activities of NASA's Educational Program Division and its Aerospace Education Services Project. Recognizing the vast explosion of knowledge resulting from the activities of the Space Program, these organizations have provided lecture-demonstrations for students and teachers to enable them to understand the ramifications of this knowledge which lie well beyond the province of the so-called "hard" or natural sciences. The ramifications also involve the industrial and domestic arts, social studies, and even the humanities. A more efficient method of imparting the latest information is through programs for inservice teachers in a workshop situation that will provide two basic functions: (1) give an overview of the space program, why we are exploring space and what we are attempting to learn as well as what we have learned thus far; and (2) show the teachers how this new knowledge can be incorporated in their particular discipline. (JD)

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KEEPING TEACHERS CURRENT THROUGH IN-SERVICE AEROSPACE WORKSHOPS

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) AND THE ERIC SYSTEM CONTRACTORS."

One of the difficulties we as teachers have simply is to keep up with new developments, the new knowledge, the new technology. We can read the newspaper; however, these accounts do not present the new discoveries in the proper context.

In science and technology, what has happened in the last 20 years? Prior to 1958, the U. S. had little capability of putting an object into Earth orbit, let alone did the world have the facilities for landing people on a planetary body and returning them safely to Earth. We have had that capability for nine years. The important factor is <u>not</u> the technical ability to place human beings on top of 6.5 million pounds of potential explosive, shoot them into space for periods of time up to 84 days where their bodies (and their organs) are floating free, the effects of gravity, the force to which we have been subjected since conception, essentially neutralized due to the counter-balancing of the gratitational force of the Earth with the centrifugal force of the forward motion of the spacecraft. No, the important factor is the ability to place man above the thin, fragile, but opaque window of our atmosphere to enable him (and us) to "see" the heavens beyond as we have never been able to accomplish before.

From an intellectual viewpoint, the space program has several major objectives. Understanding our universe is a rather gargantuan task. In order to do so, we have to place sensing devices, telescopes, spectroscopes, magnetometers, etc. in positions where they can measure.

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Stop and consider that our knowledge of the heavens and our solar system was based solely upon what man could "see" while peering upward from the surface of the earth. The major breakthrough was the development of lenses and the optical telescope. In Holland, circa 1609, Hans Lippershey is generally given credit, though we owe a great deal to Gallileo Gallilei But we are still talking about visible light. The telescope only gathered more light and sharpened the same image. In 1938, the first radio telescope began to search the heavens. This allowed astronomers to view other activity in the heavens. It is fortunate that the Earth's atmosphere has certain transparent regions or "windows", which transmit visible light, a bit of infrared and some radio waves. The highly energetic X-radiation and ultraviolet is blocked out or filtered. Thus, life as we know it can exist. However, in order to more fully understand "What is out there", we must look at the X, ultraviolet, as well as visible and infrared and radio waves.

In order to study the nature of the stars (our Sun is rather a middle class star), we must employ a variety of unmanned spacecraft which can gather this data. It is here that the fun begins -- analyzing the data. Recently, I was talking to Dr. Karl Henize, a scientist-astronaut, who was a Principle Investigator with the Skylab Project. He received his experimental results in late 1973. In 1977, he was still sifting through the mountain of data which simply concerned the Sun in extreme ultraviolet. This is a highly complex business. What does all this space business have to do with teaching?

The information explosion created by NASA and the space program has resulted in a vast increase in knowledge about the heavens, the sun, the solar system, our own planet, as well as ourselves.

It would be appropriate to interject at this point one of the so-called spin-off benefits -- that of the data handling and processing industry, the computers. NASA did not develop the computer, nor the transistor, nor the integrated circuit. However, the need for micro-miniaturized circuitry which had less weight and required smaller amounts of power were desperately needed. Thus, the fields grew rapidly because of the need in the space program. All this information, as well as the spin-off technology has resulted in a knowledge

gap for the citizens as a whole. However, this is much more a crucial situation for the in-service teachers. In order for our educational system to produce knowledgeable students, the teachers themselves must have access to the best and the most correct information available and an effective delivery system must be maintained.

Adult education is important and becoming more and more utilized by the lay public, although primarily for leisure time crafts or training for part-time employment. The New School for Social Research in New York City has pioneered adult education offerings since its inception in 1919. Presently, the Adult Division pays for its prestigious graduate school. Last term approximately 17,000 students were enrolled in about 1,050 courses. Many were non-credit. The point is that people are eager to take cultural or popular offerings. At a cost of $115 for a semester course, perhaps it won't be too long before teachers will take professional development courses on their own. The popularity of these courses lies in that they are responding to a perceived need, whether it is folk guitar, tax computation, or the history and development of motion picture cartoons. The students expect to gain something of interest and perhaps cultural value.

In the professions, in-service short courses are gaining popularity -- engineering, the pure sciences, medicine, and management, to name a few. As an example, the U.C.L.A. extension catalogue for continuing education in Engineering and Mathematics lists 34 short courses in 14 subject areas. Forty are tentatively scheduled for next summer and fall. These short courses range in 103 subject categories and are taught at the University or, if there is sufficient demand, taught at a convenient location, such as a local plant.

The American Chemical Society conducts or sponsors several short courses annually. Most of these short courses cost in the range of $80 to $125 per day for tuition and materials. What about the teaching profession? Teachers are not accustomed to these costs (which are actual expenses for the classroom, instructors and materials - with a modest factor for overhead). However, we, who have the awesome responsibility for the education of our nation's children, adolescents and young adults, must consider the manner in which we can close the knowledge gap.

Attempting to close the gap and provide some assistance for the professional growth of in-service teachers are problems which NASA's Educational Program Division and its Aerospace Education Services Project are striving to alleviate. There is a great time-lag between the research results that normally are published in journals (which are not the daily reading matter for the overworked classroom teacher) and the results of carefully massaged thought, consideration, adaptation and infusion into appropriate places in the curriculum. Estimates vary, but twenty years have been considered normal for assimilation into the curriculum. The mere inclusion of excellent photographs and/or a few disconnected but outstanding facts do not constitute new knowledge being assimilated into the curriculum.

I am not here to tell you that NASA has the answer. In fact, we desperately need your help to solve the problem of making the new knowledge readily available and usable for the in-service teacher and to their students.

In an attempt to find an efficient solution to this problem, NASA's Educational Program Division and its Aerospace Education Services Project have for 15 years served those involved in teacher education in addition to those in science education because the knowledge gained from the space program has ramifications which lie well beyond the province of the so-called "hard" or natural sciences. The ramifications also involve the industrial and domestic arts, social studies and even the humanities.

We conduct lecture-demonstrations in assembly programs to provide an overview so that the students and teachers will have a solid frame of reference upon which to understand what we are doing in the space program and why we are indeed exploring space. We also work with the teachers and the students in the classroom. With a staff of approximately 25 professionals, we conduct an average of 360 assembly programs to a combined audience of 1.1 million annually. Our other services are in addition to this. It is, of course, impractical to conduct assembly and classroom programs in all of the schools which request our services. A more efficient method of imparting the latest information is through programs for in-service teachers in a workshop situation which will provide two basic functions

(1) an overview of the space program (why we are exploring space and what we are attempting to learn as well as what we have learned thus far) and (2) show the teachers how this new knowledge can be incorporated in their particular discipline.

These teacher in-service programs have taken a variety of forms in terms of duration, intensity, and topics covered. They are conducted at the invitation of colleges, universities, and local school districts. The duration may be from a one hour in-service program to one of thirty or more hours of intensive activity. The particular subject matter will vary with the heterogeneity or homogeneity of the group. Each in-service workshop is tailored to fit the needs of the group as perceived by the workshop director.

The duration, scope and topics included vary widely, but the common factor in NASA's workshops is that they include hands-on activities. These activities provide first hand experiences which teachers may use directly or modify as necessary to fit their curricular needs.

The activities generally center around the application of the new knowledge from the space program to the participants particular teaching situation. In some cases time is devoted to individual or small group activities in order to satisfy specific needs and differences.

The secret of the appeal of these workshops lies in three primary factors:

(1) they do not require a high degree of sophistication or specialization in any one academic field to be understood. Any teacher of any subject can grasp the concepts presented and profit by taking the workshop. The reason is that aerospace concepts have their roots in all fields of learning.

(2) they deal with high interest topics and rapidly developing areas of human experience. They deal with ideas and knowledge never before understood by mankind. In a sense, these workshops place the teacher on the threshold of tomorrow.

(3) for the teacher, they relate new realms of human experience to the curriculum. For the past fifteen year,

we have used hands-on activities that the teacher undertakes in the workshop and can, in turn, adopt or adapt for his or her own students. These activities vary in their sophistication from extremely simple, unsophisticated simulation games and "cut and paste" to experiments suitable for the science laboratory. Although the space program is noted for its highly sophisticated esoteric equipment, a common denominator for our activity workshops material is the use of simple, comparatively inexpensive and readily obtainable materials.

These in-service workshops in which we have conducted or assisted are not only aerospace education, but environmental, energy, as well as science education. We have been gratified at their success and acceptance. Each year we conduct over 700 workshop sessions for approximately 9,000 teachers. Some in-service programs last only one session, while others may consist of 10 or more sessions. These workshops are conducted during the school year as well as during the summer. The rewarding factor is not that we are called back for an encore to conduct workshops at the same institutions, year after year, but rather that we find a substantial number of teachers who are taking the workshops for personal professional growth rather than the mere credit hours; furthermore, many are taking an aerospace workshop for the second or third time simply because they felt they had a great deal to gain from the newest information and suggestions for classroom activities. This indeed is a significant factor.

With courses and workshops which deal with subjects of contemporary interest, such as aerospace, environmental and energy education, the institution can offer teachers not only a profound service but provide natural attention grabbers. For these topics there are usually a variety of resources upon which the instructor can draw. These include: Department of Energy (DOE) - (Energy, Research and Development Administration (ERDA), Atomic Energy Commission (AEC)), Environmental Protection Agency (EPA), U. S. Geological Survey (USGS), Earth Resources Observation System (EROS), Federal Aviation Administration (FAA), Civil Air Patrol (CAP), as well as NASA.

We are not advocating the intervention of governmental agencies in curricular affairs, but rather utilizing the various resources available from government-sponsored research and development activities.

An experimental program was conducted this year in the State of California. The State contributes half of the cost of one of our Aerospace Education Specialists. The Specialist then spends full time working with the State Department of Education. Requests for the services are contingent upon a commitment from the school district or the school for a teacher in-service program. The programs are scheduled through the Curriculum Supervisor's Office. These in-service programs may consist of two three-hour sessions, five three-hour sessions or even two or three weeks, depending upon the need and number of teachers involved. Wherever practical, the Specialist will conduct assembly programs or classroom programs in the schools of the participating teachers.

At the present time, the program has been in effect only one semester. Our Specialist was booked solidly during this time and has virtually no free time during the second semester. The success of this program can only be judged by the response within the State as well as the fact that other states are looking into the possibility or implementing a similar program.

Next year, during the school term, we will place more emphasis on teacher in-service programs and workshops. Program inquiries may be directed to the Education Officer at the nearest NASA Center or to Educational Programs at NASA Headquarters.

Schools or school districts can request time. The itinerary will be prepared using the teacher workshops as the major guideline. If teachers are available for a series of workshops or in-service programs, then the Aerospace Education Unit (formerly known as the "Spacemobile") will be scheduled into their schools. The primary emphasis is placed on in-service teacher education.

We would be pleased to work with any educational institution which is desirous of conducting an activity workshop, including work with pre-service as well as in-service teachers. We, especially, would be most willing to work with an institution which would utilize our workshops for research studies into methodology and assimilation into the classroom.

In those areas where knowledge of a quality suitable for inclusion into the basic curricula is being generated at a rate faster than can be effectively incorporated into the textbook revisions, another delivery system must be arranged. The method which we employ is an effective means for keeping teachers current with new developments.

During this session, several typical examples of "hands-on activities" will be employed with the participants. The topics may range from environmental studies, land-use, earth resources, energy, geography, physiography, space physiology, habitability and comparative planetology.

Inquiries may be directed to the Director, Educational Programs, Mail Code LFG-13, NASA Headquarters, Washington, D. C. 20546 or to the Education Officer at the nearest NASA Field Center.